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Spatiotemporal evolution of drought episodes in Austria: A high-resolution assessment from 1950 to 2023

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BACKGROUND & OBJECTIVE

Global climate change influences the occurrence of droughts, one of the most severe climate-related hazards, posing significant threats to ecosystems and economies worldwide. Austria, a relatively small country (83.878 km²) in the Greater Alpine Region, experiences accelerated climate change (2°C temperature rise in the 20th century) compared to the worldwide average.

Thus, our purpose is to investigate at a high resolution (0.1°):

- The occurrence and evolution of drought in Austria

This was done by the calculation of the Standardised Precipitation Index (SPI) [1] and the Standardised Precipitation-Evapotranspiration Index (SPEI) [2]. Therefore, we used the monthly Reanalysis ERA5-Land data [3]

RESULTS & DISCUSSION

- Between 118 and 150 moderate SPI1 drought events
- More drought events in the western and northwestern parts
- The climate gets more variable but also wetter
- However, several extreme dry spells in the last years

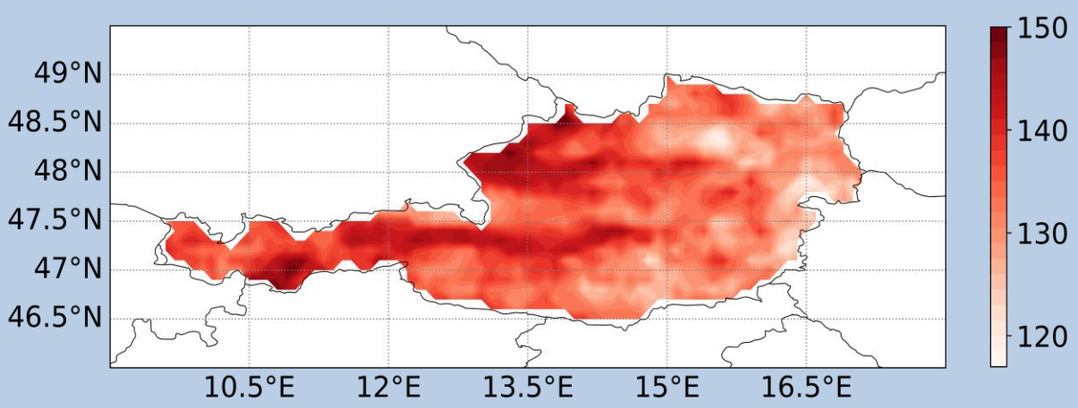

Figure 1. Number of dry spells with at least one month under -0.84 Z-Unit of SPI1 1950-2023.

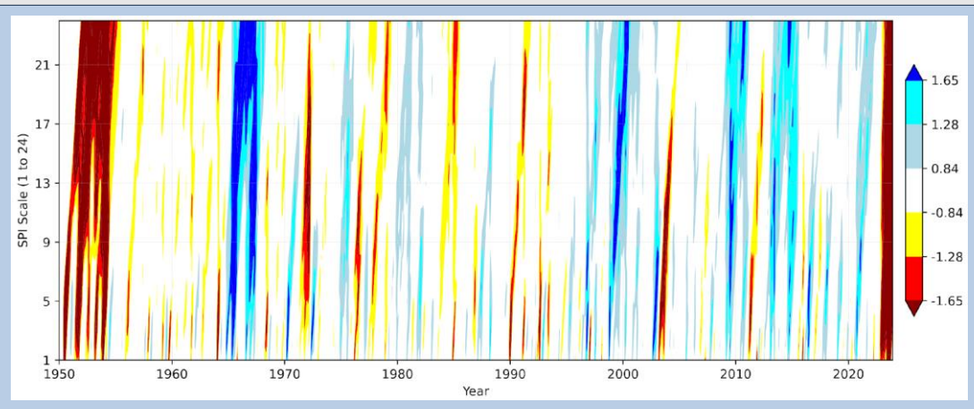

Figure 2. Temporal evolution of dry and wet conditions in Austria, according to the SPI from 1 to 24 temporal scales.

- Longtime trend: wetter climate (especially across central Austria)
- Two changepoints: 1954/55 and 2021/22
- Last years 2022/2023 very dry

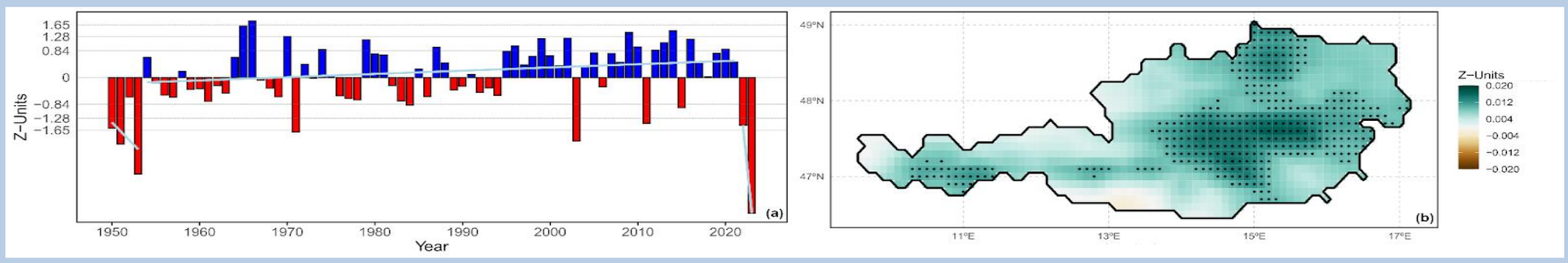

Figure 10. Temporal evolution of averaged SPI12 for December across Austria with linear trend, broken by two changepoints (1954/55 and 2021/22) (left) and map of linear trend of SPI12 for December, spatially (right), 1950-2023. Dots represent statistically significant results (p-value < 0.1).

CONCLUSION

- Spatial distribution of drought episodes suggests a strong influence of topography
- Small differences between SPI and SPEI → evapotranspiration does not play a crucial role
- Trend to wetter climate, however strong extreme dry periods in the beginning and end of the study period

References: [1] McKee, et al. (1993) https://climate.colostate.edu/pdfs/relationshipofdroughtfrequency.pdf. [2] Vicente-Serrano, et al. (2010) https://doi.org/10.1175/2009JCLI2909.1. [3] Muñoz-Sabater, et al. (2019) https://doi.org/10.24381/cds.68d2bb30.

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